REMARKS

This response responds to the Office Action dated June 30, 2004 in which the Examiner rejected claims 1, 2, 6-9, 13 an 14 under 35 U.S.C. §103.

Claims 1 and 8 claim a magnetoresistive effect thin-film magnetic head including a plurality of layers including a magnetoresistive effect multilayer in which a current flows in a direction perpendicular to surfaces of the magnetoresistive effect multilayer and an insulation gap layer. At least part of the insulation gap layer is made of Co-γFe_2O_3.

Through the structure of the claimed invention having at least part of an insulation gap layer made of maghemite, the claimed invention provides a magnetoresistive effect thin-film magnetic head in which the capacitance between the shield layers is reduced to improve the frequency characteristic of the magnetic head. The prior art does not show, teach or suggest the invention as claimed in claims 1 and 8.

Claims 1, 2, 6-9, 13 and 14 were rejected under 35 U.S.C. §103 as being unpatentable over Applicants' admitted prior art in view of *Jeffers* (U.S. Patent No. 4,754,354).

Applicant respectfully traverses the Examiner's rejection of the claims under 35 U.S.C. § 103. The claims have been reviewed in light of the Office Action, and for reasons which will be set forth below, Applicant respectfully requests the Examiner withdraws the rejection to the claims and allows the claims to issue.

Applicant's admitted prior art appears to disclose Fig. 2 illustrates a TMR element or a CPP-GMR element with a conventional structure, seen from the ABS. In the figure, reference numeral 20 denotes a lower shield layer also serving as an

electrode, 21 denotes a lower gap layer made of a metal material, which also serves as an electrode, 22 denotes a TMR layer with a multi-layered structure consisting of a lower ferromagnetic thin-film layer (free layer) / a tunnel barrier layer / an upper ferromagnetic thin-film layer (pinned layer) / an anti-ferromagnetic thin-film layer, or CPP-GMR layer with a multi-layered structure consisting of a lower ferromagnetic thin-film layer (free layer) / a nonmagnetic metal layer / an upper ferromagnetic thin-film layer (pinned layer) / an anti-ferromagnetic thin-film layer, 23 denotes an upper gap layer made of a metal material, which also serves as an electrode, 24 denotes an upper shield layer also serving as an electrode, 25 denotes hard bias layers, and 26 denotes an insulation gap layer made of an insulating material, respectively. Reference numeral 22a denotes extended parts of the lower ferromagnetic thin-film layer (free layer) extending from the TMR multilayer or the CPP-GMR multilayer to the hard bias layers 25 along the surfaces of layers of the TMR multilayer or the CPP-GMR multilayer. The TMR element or CPP-GMR element is electrically connected between the lower shield layer 20 and the upper shield layer 24 so that a sense current flows in a direction perpendicular to the surfaces of the layers. As shown in Fig. 4, the TMR element or the CPP-GMR element that utilizes the shield layers as the electrodes has not only an equivalent resistance RTMR of the TMR element or the CPP-GMR element across their output terminals but also a capacitance C_{shield} between the shield layers and a capacitance CTMR of the TMR element or the CPP-GMR element itself across their output terminals. These resistance RTMR and capacitances CTMR and Cshield form a low-pass filter causing serious deterioration of the frequency characteristics.

Thus, Applicant's admitted prior art merely discloses a CPP-GMR element. Nothing in the admitted prior art shows, teaches or suggests that at least part of an insulation gap layer is made of maghemite as claimed in claims 1 and 8.

Jeffers appears to disclose a magnetic head of the type employing a thin magnetic film structure as a magneto-resistive element responsive to the flux being sensed. (col. 1, lines 8-11) Referring now to FIG. 2, a thin film yoke-type magneto-resistive head 8' (. . . as employed herein, primed notations have been employed to indicate corresponding parts in the various drawings . . .) is shown. The SiO_2 layer 16 (shown in FIG. 1) is replaced by a layer of material 19 that is magnetically conductive (having relative high magnetic permeability), yet electrically non-conductive. The magnetically conductive layer 19 is deposited at the interface of the magneto-resistive layer 14' and the permeable layer 18'. An example of such a material useful for the layer 19 is a ferrite film such as maghemite (Fe_3O_4) that may be deposited as a thin film using the techniques disclosed in U.S. Pat. No. 4,477,319 the contents of which are hereby incorporated by reference. The magnetically conductive layer 19 allows the coupling of signal flux from the layer 18' to the layer 14' with little reluctance while at the same time permitting proper spacing to be maintained between the magneto-resistive layer 14' and the permeable layer 18'. (col. 2, lines 43-62)

Thus, *Jeffers* merely discloses using Fe_3O_4 which is in fact magnetite and **not** maghemite (Fe_3O_4). Applicant notes that Jeffers incorrectly identifies magnetite (Fe_3O_4) as maghemite (Fe_3O_4). However, U.S. Patent No. 4,477,319, which is incorporated by reference by *Jeffers*, at column 2, line 34, contains a clear definition of magnetite (Fe_3O_4) and maghemite ($\gamma\ Fe_2O_3$). Also attached to this amendment is

an excerpt from a web chemical dictionary which describes the difference between magnetite and maghemite. Applicant respectfully submits that nothing in *Jeffers* shows, teaches or suggests maghemite as claimed in claims 1 and 8. Furthermore, nothing in *Jeffers* shows, teaches of suggests using Co-γFe_2O_3 as claimed in claims 1 and 8.

Additionally, *Jeffers* newly discloses a yoke-type magneto-resistive head 8' with a single magneto-resistive layer 14'. Nothing in *Jeffers* shows, teaches or suggests upper and lower shield layers or a magneto-resistive layer as a multilayer in which current flow in a direction perpendicular to the surfaces of the layers as claimed in claims 1and 8. Rather, *Jeffers* merely discloses a yoke-type magneto-resistive head with a single magneto-resistive layer.

Since neither the prior art nor *Jeffers* shows, teaches or suggests the invention as claimed in claims 1 and 8, Applicant respectfully requests the Examiner withdraws the rejection to claims 1 and 8 under 35 U.S.C. §103.

Claims 2, 6-7, 9, 13 and 14 depend from claims 1 and 8 and recite additional features. Applicant respectfully submits that claims 2, 6-7, 9, 13 and 14 would not have been obvious within the meaning of 35 U.S.C. §103 over Applicants' admitted prior art in view of *Jeffers* at least for the reasons as set forth above. Therefore, Applicant respectfully requests the Examiner withdraws the rejection to claims 2, 6-7, 9, 13 and 14 under 35 U.S.C. §103.

The prior art of record, which is not relied upon, is acknowledged. The references taken singularly or in combination do not anticipate or make obvious the claimed invention.

Thus, it now appears that the application is in condition for reconsideration and allowance. Reconsideration and allowance at an early date are respectfully requested. Should the Examiner find that the application is not now in condition for allowance, Applicant respectfully requests the Examiner enters this Amendment for purposes of appeal.

If for any reason the Examiner feels that the application is not now in condition for allowance, the Examiner is requested to contact, by telephone, the Applicant's undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed within the currently set shortened statutory period, Applicant respectfully petitions for an appropriate extension of time. The fees for such extension of time may be charged to our Deposit Account No. 02-4800.

In the event that any additional fees are due with this paper, please charge our Deposit Account No. 02-4800.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

Date: August 30, 2004

By: ______________________
Ellen Marcie Emas
Registration No. 32,131

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Maghemite

Mineral Data Pronunciation Guide

General Maghemite Information

Chemical Formula: gamma-Fe+++2O3

Composition: Molecular Weight = 159.69 gm

Iron	69.94 %	Fe	100.00 %	Fe_2O_3
Oxygen	30.06 %	O		
	100.00 %		100.00 %	= TOTAL OXIDE

Empirical Formula: $Fe^{3+}{}_2O_3$

Environment: Formed by weathering or low-temperature oxidation of spinels containing ferrous iron, commonly magnetite or titanian magnetite. Widespread yellow pigment in sediments.

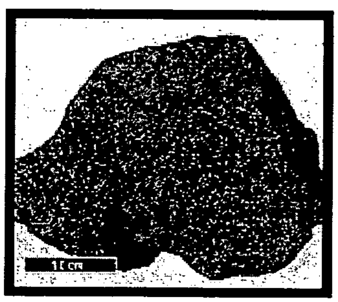
IMA Status: Valid Species (Pre-IMA)

Locality: Iron mountain mine, 9.5 miles NW of Redding, Shasta Co., California. Link to MinDat.org Location Data.

Name Origin: From MAGnetite and HEMatite, in allusion to the mineral's magnetism and composition.

Maghemite Image

Images:



Maghemite

Comments: Fine-grained massive maghemite intermixed with hematite. **Location:** Gara Djebilet, Algeria. **Scale:** See Photo.

© Jeff Weissman / Photographic Guide to Mineral Species

Maghemite Crystallography

Cell Dimensions: a = 8.339, Z = 12; V = 579.89 Den(Calc)= 5.49

Crystal System: Isometric - Tetartoidal H-M Symbol (2 3) Space Group: P 2_13

X Ray Diffraction: By Intensity(I/I_o): 1.61(1), 2.52(1), 2.95(1),

Physical Properties of Maghemite

Cleavage: None

Color: Dark brown.

Density: 4.9

Diaphaniety: Opaque

Fracture: Sub Conchoidal - Fractures developed in brittle materials characterized by semi-curving surfaces.

Habits: Massive - Uniformly indistinguishable crystals forming large masses., Massive - Granular - Common texture observed in granite and other igneous rock.

Hardness: 6 - Orthoclase

Luster: Metallic

Magnetism: Strongly magnetic

Streak: brown

Optical Properties of Maghemite

Optical Data: Isotropic.
NCalc= 2.73 - from Gladstone-Dale relationship (KC = 0.315) where Ncalc=Dcalc*KC+1
NCalc= 2.54 - from Gladstone-Dale relationship (KC = 0.315) where Ncalc=Dmeas*KC+1

RL Color: White to bluish gray.

Reflectivity

Standardized Intensity (100%)

Reflection Spectra of Maghemite in Air

λ	R	% Reflectivity 0 50 100	Σ R(λ)
400 nm	31.50		
420 nm	30.20		
440 nm	28.50		
460 nm	27.60		
480 nm	26.60		
500 nm	26.00		
520 nm	25.50		
540 nm	24.80		
560 nm	24.00		
580 nm	23.20		
600 nm	22.40		
620 nm	22.00		
640 nm	21.60		
660 nm	21.20		
680 nm	20.80		
700 nm	20.40		

Calculated Relative Intensity Colors of Maghemite in Air

Relative Intensity	0%	40%	80%	**100%**	120%	160%	200%	240%	280%	320%	360%	390%
R												

Calculated Properties of Maghemite

Electron Density: $\rho_{electron}$=**5.23 gm/cc**
note: $\rho_{Maghemite}$ =5.49 gm/cc.

Photoelectric:
$PE_{Maghemite}$ = **21.37** barns/electron

$U=PE_{Maghemite} \times \rho_{electron}$= **111.70** barns/cc.

Radioactivity: **GRapi = 0** (Gamma Ray American Petroleum Institute Units)

Maghemite is **Not Radioactive**

Maghemite Classification

Dana Class: **4.3.7.1** (4)Simple Oxides
(4.3)with a cation charge of 3+ (A+++2 O3)
(4.3.7)Dana Group
4.3.7.1 Maghemite gamma-Fe2O3 P $2_1 3$ 2 3
4.3.7.2 Bixbyite (Mn,Fe)2O3 I a3 2/m $\bar{3}$

Strunz Class: **IV/C.06-10** IV - Oxides
IV/C - Oxides with metal : oxygen = 2:3 (M2O3 and related compounds)
IV/C.06 - Ilmenite group, Maghemite series
IV/C.06-10 Maghemite gamma-Fe2O3 P $2_1 3$ 2 3

Other Maghemite Information

References: NAME(MinRec) PHYS. PROP.(Enc. of Minerals,2nd ed.,1990) OPTIC PROP.(AntBidBlaNic3)

See Also:

Links to other databases for Maghemite :
1 -Athena 2 - Crocoite.com Mineral Locations 3 - EUROmin Project 4 -Google Images 5 -MinDAT 6 -MinMax (Deutsch) 7 -MinMax(English) 8 -École des Mines de Paris

Search for Maghemite using:
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Ask about Maghemite here :

Ask-A-Mineralogist from the Mineralogical Society of America
Mindat.org's Discussion Groups
Original Rockhounds Discussion Group
Rockhounds Discussion Group on Yahoo Groups

Print or Cut-and-Paste your Maghemite Specimen Label here :

Maghemite

gamma-Fe+++2O3
Dana No: **4.3.7.1** Strunz No: **IV/C.06-10**

Locality:

Notes:

Print this Label

Magnetite

Mineral Data Pronunciation Guide

General Magnetite Information

Chemical Formula: Fe++Fe+++2O4

Composition: Molecular Weight = 231.54 gm

Iron	72.36 %	Fe	31.03 % FeO / 68.97 % Fe_2O_3
Oxygen	27.64 %	O	
	100.00 %		100.00 % = TOTAL OXIDE

Empirical Formula: $Fe^{3+}{}_2Fe^{2+}O_4$

Environment: Common accessory mineral in igneous and metamorphic rocks. Can be biogenically produced by a wide variety of organisms.

IMA Status: Valid Species (Pre-IMA) 1845

Locality: Many localities and environments world wide. Link to MinDat.org Location Data.

Name Origin: Named for Magnes, a Geek shepherd, who discovered the mineral on Mt, Ida, He noted that the nails of his shoe and the iron ferrule of his staff clung to a rock.

Synonym: ICSD 65339
Lodestone
Magnetic iron ore
PDF 19-629

Magnetite Image

Images:

Magnetite

Comments: Black, opague octahedral crystals of magnetite on matrix. **Location:** Isle of Ischia, near Naples, Compania, Italy. **Scale:** Not Given. © Lou Perloff / Photo Atlas of Minerals

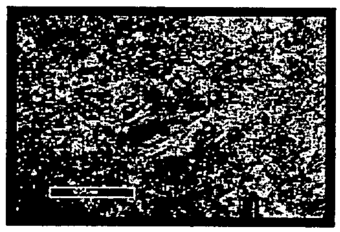
Images:

Magnetite Nordenskioldine

Comments: Colorless to white bladed crystals of nordenskiöldine with black

magnetite.
Location: Pöhla-Tellerhäuser Gallery, Pöhla, Schwarzenberg District, Erzgebirge, Saxony, Germany. **Scale:** Picture size 5 mm.
© Thomas Witzke / Abraxas-Verlag

Images:



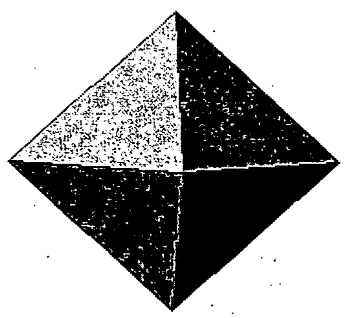
Magnetite Chesterite

Comments: Green platy chesterite in black, metallic magnetite.
Location: Near Missoula, Missoula County, Montana, USA. **Scale:** See Photo.
© Jeff Weissman / Photographic Guide to Mineral Species

Magnetite Crystallography

Cell Dimensions:	a = 8.391, Z = 8; V = 590.80 Den(Calc)= 5.21
Crystal System:	Isometric - HexoctahedralH-M Symbol (4/m $\bar{3}$ 2/m) Space Group: F d3m
X Ray Diffraction:	By Intensity(I/I_o): 2.53(1), 1.483(0.85), 1.614(0.85),
Forms:	

Mouse
Dbl Clk - Start-Stop Rotation
RMB - Cycle Display Modes
Drag1 - Manipulate Crystal
Drag2 - Resize
Keyboard
S - Stereo
I - Indicies
<space> - Start-Stop Rotation
F - Fit to Screen
M - Menu
Help on Above



Forms: **[1 1 1]**

Large Pop-Up

Warning: this large pop-up is very compute intensive and may not work well with some computers.

Physical Properties of Magnetite

Cleavage:	None
Color:	Grayish black, Iron black.
Density:	5.1 - 5.2, Average = 5.15
Diaphaniety:	Opaque
Fracture:	Sub Conchoidal - Fractures developed in brittle materials characterized by semi-curving surfaces.
Habits:	Massive - Uniformly indistinguishable crystals forming large masses., Massive - Granular - Common texture observed in granite and other igneous rock., Crystalline - Fine - Occurs as w ell-formed fine sized crystals.
Hardness:	5.5-6 - Knife Blade-Orthoclase
Luminescence:	None.
Luster:	Metallic

Magnetism: Naturally strong

Streak: black

Optical Properties of Magnetite

Optical Data: Isotropic, n=2.42.

RL Color: Gray with brownish tint.

Reflectivity

Standardized Intensity (100%)
Reflection Spectra of Magnetite in Air

λ	R	% Reflectivity 0 50 100	Σ R(λ)
400 nm	22.30		
420 nm	21.80		
440 nm	21.30		
460 nm	20.80		
480 nm	20.50		
500 nm	20.30		
520 nm	20.30		
540 nm	20.40		
560 nm	20.50		
580 nm	20.60		
600 nm	20.60		
620 nm	20.70		
640 nm	20.80		
660 nm	20.90		
680 nm	21.00		
700 nm	21.20		

Calculated Relative Intensity Colors of Magnetite in Air

Relative Intensity	0%	50%	100%	150%	200%	250%	300%	350%	400%	430%
R										

Calculated Properties of Magnetite

Electron Density: $\rho_{electron}$**=4.95 gm/cc**

note: $\rho_{Magnetite}$ =5.21 gm/cc.

Photoelectric: **$PE_{Magnetite}$ = 22.14** barns/electron

U=$PE_{Magnetite}$ x $\rho_{electron}$= 109.58 barns/cc.

Radioactivity: **GRapi = 0** (Gamma Ray American Petroleum Institute Units)

Magnetite is **Not Radioactive**

Magnetite Classification

Dana Class: **7.2.2.3** (7)Multiple Oxides

(7.2)(A+ B++)2 X4 Spinel group

(7.2.2)(Iron subgroup)

7.2.2.1 Magnesioferrite MgFe2O4 F d3m 4/m $\bar{3}$ 2/m

7.2.2.2 Jacobsite (Mn,Fe,Mg)(Fe,Mn)2O4 F d3m 4/m $\bar{3}$ 2/m
7.2.2.3 Magnetite FeFe2O4 F d3m 4/m $\bar{3}$ 2/m
7.2.2.4 Franklinite (Zn,Mn,Fe)(Fe,Mn)2O4 F d3m 4/m $\bar{3}$ 2/m
7.2.2.5 Trevorite NiFe2O4 F d3m 4/m $\bar{3}$ 2/m
7.2.2.6 Cuprospinel (Cu,Mg)Fe2O4 F d3m 4/m $\bar{3}$ 2/m
7.2.2.7 Brunogeierite (Ge,Fe)Fe2O4 F d3m 4/m $\bar{3}$ 2/m

Strunz Class: **IV/B.02-20** IV - Oxides
IV/B - Oxides with metal : oxygen = 3:4 (spinel type M3O4 and related), Ferrite-Spinels
IV/B.02 - Spinel group, Magnesioferrite - Franklinite series

IV/B.02-10 Magnesioferrite MgFe2O4 F d3m 4/m $\bar{3}$ 2/m
IV/B.02-20 Magnetite FeFe2O4 F d3m 4/m $\bar{3}$ 2/m
IV/B.02-30 Jacobsite (Mn,Fe,Mg)(Fe,Mn)2O4 F d3m 4/m $\bar{3}$ 2/m
IV/B.02-40 Trevorite NiFe2O4 F d3m 4/m $\bar{3}$ 2/m
IV/B.02-50 Cuprospinel (Cu,Mg)Fe2O4 F d3m 4/m $\bar{3}$ 2/m
IV/B.02-60 Franklinite (Zn,Mn,Fe)(Fe,Mn)2O4 F d3m 4/m $\bar{3}$ 2/m

Other Magnetite Information

References: NAME(Dana8) PHYS. PROP.(Enc. of Minerals,2nd ed.,1990) OPTIC PROP.(AntBidBlaNic3)

See Also:

Links to other databases for Magnetite :
1 - Alkali-Nuts(English) 2 - Alkali-Nuts(Francais) 3 - Am. Min. Crystal Structure DB 4 - Applied Mineralogy 5 - Athena 6 - Crocoite.com Mineral Locations 7 - EUROmin Project 8 - Franklin Minerals(Dunn) 9 - Franklin Minerals (Palache) 10 - Glendale Community College 11 - Google Images 12 -MinDAT 13 -MinMax(Deutsch) 14 - MinMax(English) 15 - Mineral and Gemstone Kingdom 16 - Minerals of Wisconsin 17 - Scandinavian mineral gallery 18 -The Mineral Gallery 19 - UCLA - Petrography Thin-Sections 20 -University of Colorado - Mineral Structure Data 21 - University of Manchester - Mineral Structure 22 -University of Minnesota 23 - WWW-MINCRYST 24 -theimage 25 -École des Mines de Paris

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Exceptional Minerals
Fabre Minerals
Trinity Mineral Company - Rare Minerals
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Dan Weinrich Fine Minerals
Wright's Rock Shop

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Mindat.org's Discussion Groups
Original Rockhounds Discussion Group
Rockhounds Discussion Group on Yahoo Groups

Print or Cut-and-Paste your Magnetite Specimen Label here :

Magnetite

Fe++Fe+++2O4
Dana No: **7.2.2.3** Strunz No: **IV/B.02-20**

Locality:

Notes:

Print this Label

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